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Density Wave Dispersion Behavior in Saturn's A Ring

L.J. Spilker (JPL/Caltech)

Wave dispersion profiles were generated for approximately 30 spiral density waves observed in the Voyager photopolarimeter stellar occultation data of Saturn's A ring. The majority of these density waves disperse linearly over the bulk of the wave. Some of the strongest density waves, however, do not begin to disperse linearly until well past the resonance location. An algorithm based on an autoregressive power spectral technique, Burg 2, generated the dispersion profiles. The dispersion behavior was then used to calculate local surface mass densities in the vicinity of each wave. Surface mass densities for the strongest density waves, when calculated using the region where the waves begin to disperse linearly, are in good agreement with surface mass densities calculated for nearby, weaker density waves.

Some of the Prometheus density waves external to the Encke gap exhibit unusual spectral structure in the first part of the wave as the frequency increases by 60-70% over a short radial interval. The nearby, related second-order resonances may produce density waves that distort the beginning of the first-order density waves. The separation distance between these first- and second-order resonances is only 0.4 to 1.5 km in this region of the rings. When the early part of each wave is systematically omitted in the surface mass density estimates, lower surface mass densities result for all of these density waves.

This work was done at JPL/Caltech under contract with NASA.

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